Worksheet 16 (Scheduling 1):
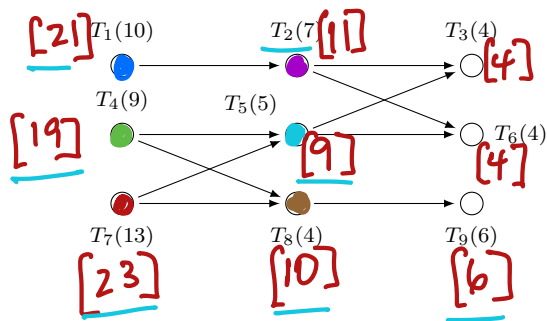## Critical Path Algorithm

Group Names: _Solutions_

1. Consider the following digraph:

time	ready	done
0	$T_7\,T_1\,T_4$	
10	$T_4\,T_2$	T_1
13	$T_2\,T_8$	T_7
19	$T_8\,T_5$	T_4
20	T_5	T_2
23	T_9	T_8
25	$T_3\,T_6$	

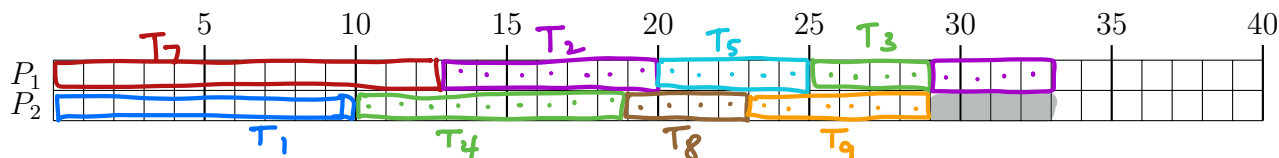| time	ready	done
29	T_6	T_3, T_9
33		T_6

(a) Use the backflow algorithm to label each vertex in the digraph.

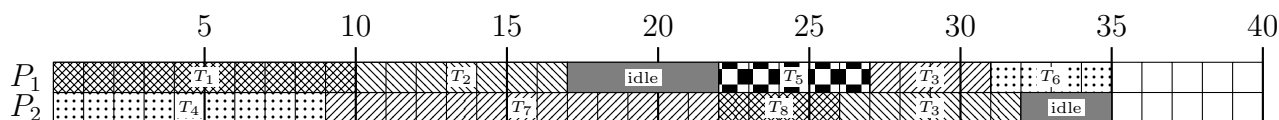(b) Construct a priority list using the Critical Path algorithm.

$$T_7, T_1, T_4, T_2, T_8, T_5, T_9, T_3, T_6$$

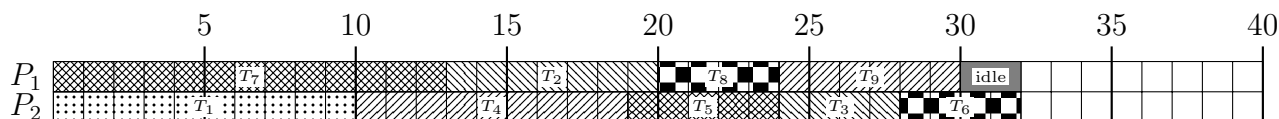(c) Construct a schedule that corresponds to the priority list you just found.

(d) The schedules that you found on the previous worksheet are shown below:

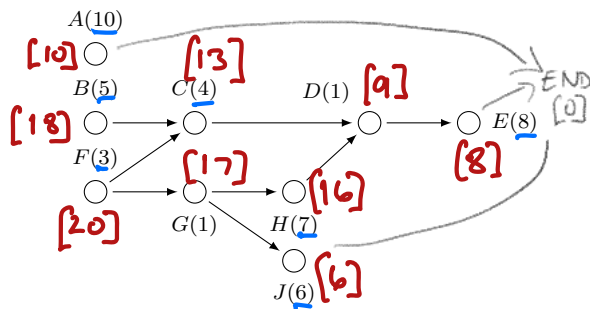Priority List $T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9$

Priority list from the Decreasing Time Algorithm: $T_7, T_1, T_4, T_2, T_9, T_5, T_3, T_6, T_8$

(e) How does the Critical Path schedule compare to the other schedules you found?

It is longer than decreasing time but shorter than the first one.

1

2. Typically the Critical Path algorithm produces a very good schedule, but it may or may not be optimal. Consider the following digraph:

A(10)
[10] ○   [13]   D(1) [9]
B(5)   C(4)   END [0]
[18] ○ →   ○   →   ○ → ○ E(8)
F(3)   [17]   [16]   [8]
○   →   ○ → ○
[20]   G(1)   H(7) [6]
              ○
         J(6) [6]
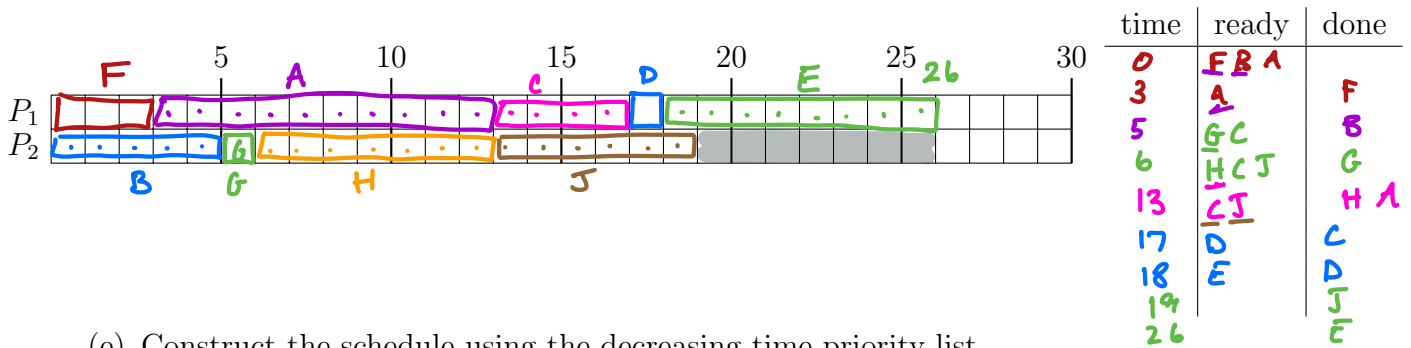
(a) Label the graph using the backflow algorithm.

(b) Construct the priority list corresponding to the critical path algorithm.
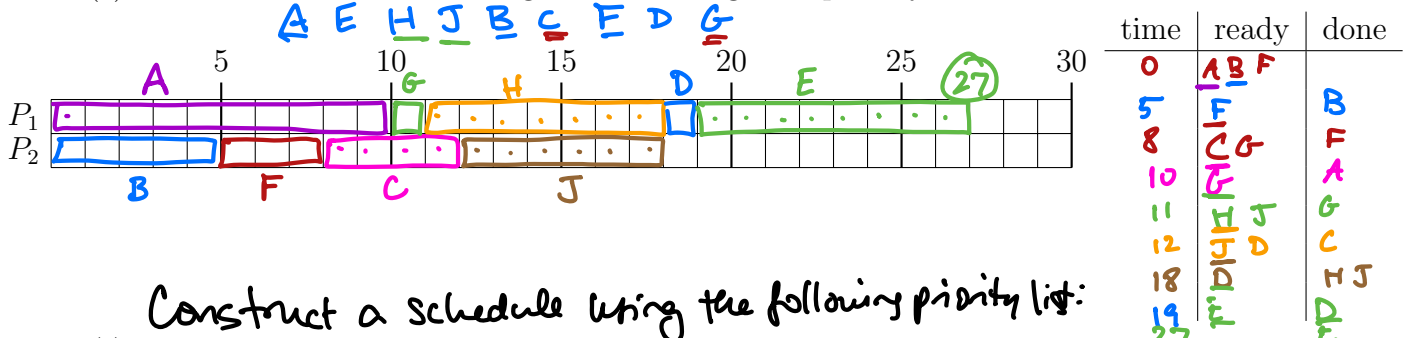
$$F, B, G, H, C, A, D, E, J$$

(c) Construct the priority list corresponding to the decreasing time algorithm.

$$A, E, H, J, B, C, F, D, G$$

(d) Construct the schedule using the critical path priority list.

time	ready	done
0	F B A	
3	A	F
5	G C	B
6	H C J	G
13	C J	H A
17	D	C
18	E	D J
19		E
26		

(e) Construct the schedule using the decreasing time priority list.

$$A E H J B C F D G$$

time	ready	done
0	A B F	
5	F	B
8	C G	F
10	G	A
11	H J	G
12	D	C
18		H J
19		D
27		E

Construct a schedule using the following priority list:

(f) ~~Construct the schedule you get using the critical path algorithm, *except put task A at the end of the priority list.*~~ $$F B G C H J D A E$$

time	ready	done
0	F B A	
3	G A	F
4	H J A	G
5	C J A	B
9	J D A	C
11	D A	H
12	A E	D
15	E	J
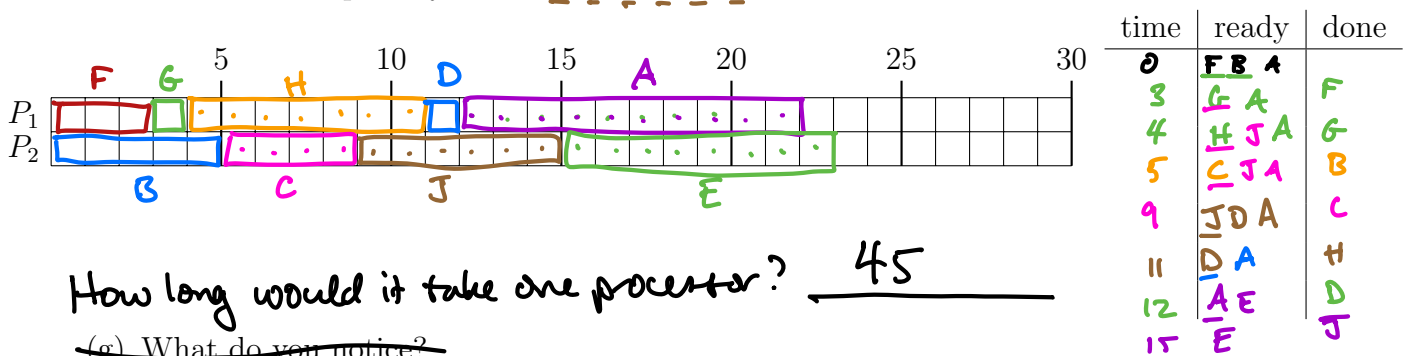
How long would it take one processor? ___45___

~~(g) What do you notice?~~

Explain why the schedule in (f) must be optimal for 2 processors.
Splitting the total times as equally as possible between 2 processors.
$\frac{45}{2} = 22.5$ So 23 must be the best we can do.